METHOD FOR GENERATING AND DISPLAYING HOT LINK IN PANORAMIC THREE-DIMENSIONAL SCENE AND DEVICE THEREFOR

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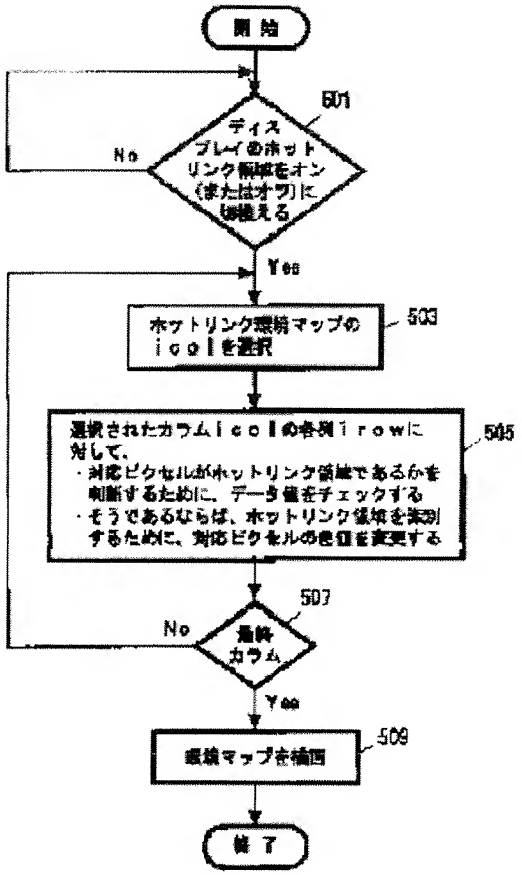
Abstract of **JP10091814**

PROBLEM TO BE SOLVED: To provide a method and device for generating and displaying a hot link in a panoramic three-dimensional scene by improving interactive graphical feedback. SOLUTION: A hot link area in a panorama scene expressed by a first environmental map including plural elements which are made correspond to each color value indicating the color of the corresponding element is defined by a second environmental map including plural elements. The elements of the second environmental map are made correspond to the elements of the first environmental map based on a mapping function. Also, at least one element of the second environmental map is made correspond to hot link data for identifying an action to be executed when a user selects at least one element of the first environmental map corresponding to at least one element of the second environmental map.



Field of the Invention

[00001] Generally this invention relates to the image processing system with which an image processing system, especially a user make it possible to generate the data which express one scene by many images to a panorama three-dimension image, and to carry out a screen display.

Description of the Prior Art

[00002] Conventional three-dimension graphic application and related hardware draw the scene which consists of one or more 1-dimensional objects. Usually, a body is expressed with the shape of a geometric basic form, for example, a triangle. Moreover, a body is expressed by the graphic data showing basic form-like the location and color in model system of coordinates. A graphic device draws this scene, in order to display the object of the scene which can be seen in a view window based on a view. A user can move by changing the location and orientation of view criteria (camera) in the inside of a scene. Furthermore, activation of animation can be performed by moving in the location of a series of preselected view criteria, and the inside of orientation.
[0003] For a computer, drawing actuation is a process using an effort and is usually performed by the graphic hardware of dedication. Although such a system is highly efficient, since the hardware of the dedication assigned for the purpose is needed, costs start.
[0004] Furthermore, in the conventional three-dimension graphic application system, a user offers the three-dimension model (namely, graphic data showing the location and color of geometric criteria of a scene in model system of coordinates) of a scene. The software used together with peripheral devices (a pen tablet, a scanner, camera, etc.) may generate such a model. For example, a user can make the three-dimension model of a scene using the software currently sold as it is also at the trade name of CATIA by Daussault of France. However, at an expensive price, even if such model ring software is an imperfect scene relatively, the labor cost needed for modeling may attach it highly.
[0005] Since the cost relevant to the conventional three-dimension graphic system was high, the solution replaced with it appeared. This solution is effective. However, at the point generated and visualized, a limitation is in capacity in generation about the three-dimension scene which is suitable for use with a standard personal computer, and does not need the hardware for graphics of dedication. As an example of such a solution, software called QuicktimeVR in a trade name is Apple. It is developed by Computer and sold. This QuicktimeVR software is divided into two different packages. The 1st package is an authoring tool which enables a content provider to be sold to a content provider and to develop a solid three-dimension image from many views of one scene. The 2nd package is a viewer distributed to a consumer, and becomes possible [seeing the three-dimension image created by the authoring tool]. About the still more detailed publication about actuation of a QuicktimeVR system, it is reference:Chen, "QuicktimeR VR-An Image-based Approach to Virtual Environment Navigation", SIGGRAPH 1995, Los Angeles, CA, and pp.29-38, It reaches. Apple It is good to refer to U.S. Pat. No. 5,396,583 (Chen et al.) transferred to Computer.
[0006] A QuicktimeVR system displays the three-dimension image of one scene (or assembly of two or more images) using a cylindrical environmental map. It is drawn when different perspective drawing maps a cylindrical environmental map in a desired viewing window. A hot link is the field of the panorama scene matched with action. For example, action corresponding

to a hot link may load and display the 2nd environmental map, and may generate multimedia events, such as an audio clip or a video clip.
[0007] A QuicktimeVR system offers the hot link included in a panorama scene. When a user moves cursor to the field of the scene corresponding to a hot link, and the configuration of the cursor on a display changes, a user gets to know the location of a hot link.

Problem(s) to be Solved by the Invention

[00008] However, there is a limitation in the above-mentioned conventional approach. It is because a user has to move about in a panorama scene in order to trace the location of the hot link included in the scene. Therefore, the system much more more effective than that for including a hot link in a three-dimension panorama image from the former is called for.
[0009] Therefore, this invention is made in view of the above-mentioned situation, and it aims at offering the approach and equipment which improve interactive graphical feedback, and generate and display a hot link on a panorama three-dimension scene.

Means for Solving the Problem

[00010] It solves with the approach and equipment which generate and display a hot link on the panorama three-dimension scene based on this invention for the above-mentioned conventional trouble and the trouble relevant to it. The hot link field in this scene is defined on the panorama scene expressed by the 1st environmental map containing two or more elements with which each was matched with the color value showing the color of a corresponding element by the 2nd environmental map containing two or more elements. The element of the 2nd environmental map is equivalent to the element of the 1st environmental map based on a mapping function. Moreover, at least one element of the 2nd environmental map is matched with the hot link data which identify action performed in case a user chooses at least one of the 1st environmental map corresponding to at least one element of the 2nd environmental map. Preferably, the hot link data matched with at least one element of the 2nd environmental map have the item of the table matched with said data which identify action performed in case a user chooses at least one element of the color value matched with the element of the 2nd environmental map, and the 1st environmental map.
[0011] By the hot link field defined on the 2nd environmental map identifying at least one element of the 2nd environmental map, and changing at least one color value of the 2nd environment, it is displayed and the 1st environmental map changed by it is generated. And the 1st environmental map changed for the display is drawn.

Embodiment of the Invention

[00012] Hereafter, the approach and equipment which appoint and display the range of a hot link in an environmental map are explained. This invention is applicable to any computer processing systems, such as a graphic adapter which operates with a personal computer, a workstation, a personal computer, or a workstation. As shown in drawing 1 , generally a computer processing system which is used by this invention is equipped with memory 01, at least one arithmetic and program control (CPU) 101, and at least one user input equipment 107 (for example, a keyboard, a mouse, a joy stick, a voice recognition unit, or handwriting recognition equipment). moreover,

other nonvolatile storages 108, such as nonvolatile memory, such as ROM, and (or) a fixed-disk drive, are contained in a computer processing system. This nonvolatile storage 108 is read into memory 101, and the operating system and one or more application programs which are further performed by CPU103 are stored. on the occasion of activation of an operating system and an application program, CPU may use the data stored in a nonvolatile storage 108 and (or) memory 101.

[0013] Furthermore, a computer processing system has a frame buffer 104 among the indicating equipments 104, such as CPU103, a CRT display, or a LCD display. The pixel data for driving an indicating equipment 105 are contained in this frame buffer 104. In some systems, the drawing equipment (un-illustrating) called the graphic accelerator may be formed between CPU103 and a frame buffer 104.

[0014] Furthermore, a computer processing system may be equipped with the communication link 109 (for example, a network adapter, RF link, or a modem) linked to CPU103. CPU103 -- this communication link 109 -- going -- others (going via the Internet) -- it becomes possible to communicate with computer system. CPU103 may receive the part of the data used by this CPU103 when performing the part of an operating system, the part of an application program or an operating system, and an application program.

[0015] The application program with which what should be observed here is performed by CPU103 can perform the drawing approach of this invention which the following indicates. Or oneself [whole / which is indicated below / of the drawing approach / the part or the whole] may be ingratiated by the hardware which operates with the application program performed by CPU103.

[0016] Hereafter, an environmental map and the hot link environmental map which sets the range of a hot link field to this environmental map are explained. An environmental map given in the following is a cylindrical environmental map. However, this invention is not limited to this and may be applied to the environmental map of arbitration, for example, the spherical environmental map indicated by the United States patent application 60th / No. 022 or 428, and the environmental map of a polyhedron. In addition, these the United States patent applications of all are used as some of these specifications.

[0017] A cylindrical environmental map consists of a rectangle-like array of an element or a pixel, and the data showing the part of a three-dimension scene including the narrow pyramid where the range was appointed by the origin of a cylindrical shaft and the field of the shape of a rectangle of the peripheral surface of this cylinder are contained in each pixel.

[0018] Each pixel of a cylindrical environmental map may be characterized with a train index and a column index. A train index corresponds to the azimuth relevant to a cylindrical shaft and a cylindrical radix point, and a column index corresponds to the elevation angle relevant to a cylindrical shaft and a cylindrical radix point. Drawing 2 shows the developed cylindrical environmental map. This map has the train index / azimuth of a pixel, a corresponding horizontal axis, and the vertical axes corresponding to the train index / elevation angle of this pixel further. A cylindrical environmental map has a PanRow column and a PanCol train, as illustrated. It has a color value over the azimuth of 0 thru/or 2pi within the limits, and the reliance of a partial panorama is [a perfect panorama] also good including the color value over the azimuth of the subset of this range. The reliance of a mho bus panorama is also good including the color value over the azimuth which is within the limits of 0 thru/or 4pi. Still more detailed explanation of a cylindrical map can be found out to the United States patent application number 60 / No. 023 or

143. In addition, the publication of this whole United States patent application is used as some of these specifications.

[0019] According to this invention, the hot link field of a cylindrical environmental map is defined by the hot link environmental map, and carries out the map of the pixel of a hot link environmental map to the pixel of a cylindrical environmental map by the mapping function. As shown in drawing 3 , preferably, a hot link environmental map is a cylindrical environmental map which has a HRow column and a HCol train, a HRow column is determined by breaking the PanRow column of a cylindrical environmental map by the scale factor SR, and a HCol column is determined by breaking the PanCol column of a cylindrical environmental map by the scale factor SC. That is, the column of a hot link environmental map (HRow, HCol) and the number of trains are drawn by reducing the column of a cylindrical environmental map (PanRow), and the number of trains.

[0020] This example of an operation gestalt can express the pixel of a hot link environmental map by Formula H (i, j). Range of i is the column characteristics from 0 to (HCol-1) among this formula, and range of j is the train characteristics from 0 to (HRow-1). Moreover, the pixel of a cylindrical environmental map can be expressed with Formula P (x y). The range of x is the column characteristic of 0 to (PanCol-1) among this formula, and range of y is the train characteristics from 0 to (PanRow-1). In this case, each pixel of a hot link environmental map corresponds to one SRxSC block of the pixel in a cylindrical environmental map. By the following formulas, this relation is expressed and can carry out things. Namely, [Equation 1]

H (i, j) == P (x y) P (x+1, y) ... P (x+sc -1, y) P (x y+1) P (x+1, y+1) ... P (x+sc -1, y+1) - - - - - - - - - P(x y+SR -1) P (x+1, y+SR -1) ... the inside of P (x+SC -1, y+SR -1) type, x=SR*i, and y=SC*i -- for example It is drawn when the train of a hot link environmental map (HRow, HCol) and the number of columns contract by the multiplier 4 with the train of a cylindrical environmental map (PanRow, PanCol), and the number of columns. In this case, the mapping function which carries out the map of the pixel of the hot link environmental map H (i, j) to 16 pixels of a cylindrical environmental map can be expressed with the following formulas. Namely, [Equation 2]

[0021] About each pixel of a hot link environmental map, the data value as which the correspondence pixel of a cylindrical environmental map specifies whether it is a hot link field is stored. Moreover, the information which shows the command or action performed about each pixel of a hot link environmental map when a user chooses the correspondence pixel of the hot link in a cylindrical environmental map (or it sets) may be stored.

[0022] The data value by which each pixel ****** storing of the hot link environmental map which specifies whether the correspondence pixel of a cylindrical environmental map is a hot link field was carried out may be coded with the red of the pixel of a hot link environmental map, green, or a blue value. For example, you may specify whether the correspondence pixel of a cylindrical environmental map is a hot link field using the red value of each pixel. In this case, blue and a green color value can be disregarded. Furthermore, the red value of nothing is stored about the pixel of the hot link environmental map corresponding to the pixel of the hot link environmental map which is not a part of hot link field. However, since it is within the limits of predetermined [of a color value] about the pixel of the hot link environmental map corresponding to the pixel of the cylindrical environmental map which is not a part of hot link field, a value is stored preferably. That is, when a red value is in the color value of the

a red value]. Supposing the correspondence pixel of a cylindrical environmental map is not the part of a hot link field, the processing in step 505 will progress to the following pixel in a train.
[0030] However, supposing the correspondence pixel of a cylindrical environmental map is the part of a hot link field, a table will be searched preferably and it will be determined whether the red value corresponding to a pixel is stored as an effective item in a table. As for this step, a pixel checks corresponding to a hot link field. When an item in agreement is not found in a table, processing of step 505 progresses to the following pixel in a train.
[0031] If an item in agreement is found, the pixel of the cylindrical environmental map which is in agreement with a pixel (irow, icol) will be determined based on a mapping function. Furthermore, about each correspondence pixel of a cylindrical environmental map, in order to identify a pixel as a part of a hot link field, the color value of a pixel is corrected.
[0032] preferably, the color value of the correspondence pixel of the hot link field of a cylindrical environmental map is corrected by reversible actuation to red, blue, and (or) a green color value. for example, supposing the true color value of 24 bits is stored about each pixel of a cylindrical environmental map, red, blue, and (or) a green component can also be determined as follows. Namely, [Equation 3] New price = modification (2.56 old value +128)
In other examples, supposing a 8-bit pallet color pointer is stored about each pixel of a cylindrical environmental map, the changed pallet color pointer can also be determined as follows. Namely, [Equation 4]
New pointer = modification (256 old pointer +128)
The point which was excellent in such actuation is a point of the ability to make modification retrace one's steps by performing actuation twice. Therefore, after a user inputs the command which switches the display of a hot link field off, it is not necessary to search the cylindrical environmental map data which are not changed, or to load again.
[0033] At step 507, it judges whether the last column of a hot link environmental map was processed. When it is judged that it is not processed, actuation chooses return and the next value of icol as step 503. When it is judged that the last column of a hot link environmental map was processed, actuation progresses to the following step 509.
[0034] At step 509, after all the columns and trains of a hot link environmental map are processed, a modification cylindrical environmental map is drawn for the purpose of a display. About the detail of drawing actuation, it is indicated by the United States patent application 60th / No. 023 or 143, and this whole United States patent application is used as some of these specifications. Consequently, when a user's input command is a command switched to ON, the hot link field defined on the hot link environmental map is displayed. However, when a user's input command is a command switched off, step 509 displays the cylindrical environment which is not changed (that is, a hot link field is not displayed).
[0035] The outline of the above-mentioned procedure has quite few pixels in a hot link environmental map than the number of pixels of a cylindrical environmental map, and when almost all the pixels of a hot link environmental map are not matched with a certain action (that is, most is cold), it is advantageous.
[0036] Another procedure for displaying the hot link field defined on the hot link environmental map is explained referring to drawing 6 . Actuation is started at step 601 and it confirms whether require that a user input command should switch the display of a hot link field to ON (or off). Generally a user input command is identified by the I/O event (or message). Reception of the user input command which requires that a user input command should switch the display of a hot link field to ON (or off) at step 601 advances actuation to step 603.

[0037] At step 603, the column index icol corresponding to one of the columns of a cylindrical environmental map is chosen. Preferably, the column index icol is set as the value which within the limits from 0 to (PanCol-1) follows.
[0038] At step 605, a column index is chosen about each train of the column icol with which the cylindrical environmental map was chosen. Preferably, the train index irow is set as the value which within the limits from 0 to (PanRow-1) followed. Next, as each pixel (irow, icol) of a cylindrical environmental map is the following, it is processed at step 605.
[0039] To the beginning, the pixel of the hot link environmental map corresponding to the current pixel (irow, icol) of a cylindrical environmental map is identified. For example, it is the following, and the pixel of the hot link environmental map (jrow, jcol) corresponding to the present pixel (irow, icol) of a cylindrical environmental map can be made and identified. Namely, [Equation 5] It is SC=PanRow/HRow among a jcol = icol/SCjrow = irow/SC type, and the ratio of the number of columns of a cylindrical environmental map and the number of trains of a hot link environmental map is expressed.
[0040] The data value relevant to the pixel (jrow, jcol) of a hot link environmental map is checked by the 2nd, and this data value determines whether the correspondence pixel of a cylindrical environmental map is a hot link field. If the red value of a pixel is the hot link field which the correspondence pixel of a cylindrical environmental map described above, a pixel has it within the limits of predetermined [of a red value]. Supposing the red value of a pixel is not the part of a hot link field which the correspondence pixel of a cylindrical environmental map described above, processing of step 605 will be performed to the next pixel of the train of a cylindrical environmental map.
[0041] However, if the correspondence pixel of a cylindrical environmental map is the part of a hot link field, it will judge whether a table is searched preferably and the red value related to a pixel (jrow, jcol) is stored as an effective item of a table. A pixel (jrow, jcol) becomes certain [dealing with a hot link field] by this step. When an item in agreement is not found in front Naka, processing at step 605 follows the next pixel of the train of a cylindrical environmental map.
[0042] Supposing an item in agreement is found, the color value of the pixel (irow, icol) of a cylindrical environmental map will be changed, and a pixel will be identified as a part of a hot link field. preferably, the color value of the pixel (irow, icol) of the hot link field of a cylindrical environmental map is changed by pixel red, blue, and (or) the reversible operation to a green value. for example, supposing the true color value of 24 bits is stored about each pixel of a cylindrical environmental map, red, blue, and (or) the modification value of a green component are the followings, and can be made and determined. Namely, [Equation 6] A new value = modification (256 old value +126)
[0043] As other examples, supposing a 8-bit pallet color pointer is stored about each pixel of a cylindrical environmental map, a modification pallet color pointer is the following, and can be made and determined. Namely, [Equation 7] A new pointer = modification (256 old pointer +128)
[0044] By repeating actuation twice, I hear that the point which was excellent in this actuation can return modification, and there is. Therefore, after the user input command which switches the display of a hot link field off is received, it is not necessary to search the data of the cylindrical environmental map which has not been changed (or reloading).
[0045] At step 607, it judges whether the last column (PanCol-1) of a cylindrical environmental map was processed. If not processed, actuation chooses return and the next value of icol as step

603. Supposing the last column (pancol-1) of a cylindrical environmental map is processed, actuation will progress to step 609.
[0046] At step 609, after all the columns of a cylindrical environmental map and processing of a train are completed, a modification cylindrical environmental map is drawn for a display. The detail of the drawing approach is indicated by the United States patent application 60th / No. 023 or 143. In addition, the contents of an indication of this whole specification are used as some of these specifications. Consequently, when a user's input command is a command switched to ON, the hot link field defined on the hot link environmental map is displayed. However, when a user's input command is a command switched off, step 509 displays the cylindrical environment which is not changed (that is, a hot link field is not displayed).
[0047] Another procedure for displaying the hot link field defined on the hot link environmental map is explained referring to drawing 7 and drawing 8 . This actuation is started at step 701 and a user input command confirms whether require that the display of a hot link field should be switched to ON (or off). Generally a user input command is identified by the I/O event (or message). Reception of the user input command which requires that a user input command should switch the display of a hot link field to ON (or off) at step 701 advances actuation to step 703.
[0048] At step 703, the column index icol corresponding to one of the columns of a cylindrical environmental map is chosen. Preferably, the column index icol is set as the value which within the limits from 0 to (PanCol-1) follows.
[0049] At step 705, the column (jcol) of the hot link environmental map corresponding to a current column (icol) is identified. For example, the column (icol) of the hot link environmental map corresponding to the current column (icol) of a cylindrical environmental map may be determined as follows. Namely, [Equation 8] jcol = It is SC=PanRow/HRow among an icol/SC type and the ratio of the number of columns of a cylindrical environmental map and the number of trains of a hot link environmental map is expressed.
[0050] It judges whether it is satisfied with step 707 of one of the following two conditions.
(a) The conditions that a current column (icol) is the 1st column of a cylindrical environmental map (for example, icol=0). Or the conditions that the correspondence column (jcol) of (b) hot link environmental map differs from the column (jcolprev) from which the hot link environmental map was already discriminated (for example, jcol!=jcolprev and jcolprevin formula = (icol-1) / SC).
[0051] Supposing it satisfies one of the two above-mentioned conditions, actuation progresses to step 709, and when it satisfies neither, it will progress to step 711 (drawing 8).
[0052] At step 709, the train index jrow corresponding to one of the trains of a hot link environmental map is chosen in a hot link. Preferably, the train index jcol is set as the value which continues in the range from 0 to (jrow, jcol). The data value relevant to the pixel (jrow, jcol) of a hot link environmental map is checked, and this data value judges whether the correspondence pixel of a cylindrical environmental map shows that it is a hot link field. When processing the train of a current column (jcol), the train of the last which stores the data value which the first train which stores the data value which shows that the correspondence pixel of a cylindrical environmental map is a hot link field is stored as jrowl, and shows that the correspondence pixel of a cylindrical environmental map is a hot link field is stored as jrow2. When there is no train in the current column (icol) of the hot link environmental map which stores the data value which shows that the correspondence pixel of a cylindrical environmental map is a hot link field, jrowl and jrow2 are preferably saved as each (Hrow-1) and 0 (or pair of

the arbitration which consists of a number with which are satisfied of jrowl>jrow2). After checking all the trains of a current column (icol), the train (irow1, irow2) of the cylindrical environmental map corresponding to trains jrow [jrowl and] 2 is identified. For example, the train of a cylindrical environmental map (irow1, irow2) is also discriminable as follows. Namely, [Equation 9] irow1=jrowl*SCirow2=jrow2*SC [0053] Therefore, actuation of step 709 is completed and actuation progresses to step 711 further.

[0054] At step 711, the column (icol) with which the cylindrical environmental map was chosen is checked about a hot pixel. However, each train of the selected column (icol) (for example, the pixel corresponding to irow2 is examined from the train irow1 of the selected column (icol) instead of checking irow=0 to (panRow-1).) This will be attained by setting the train index irow as the value which continues within the limits of irow1 to irow2. The pixel (irow, icol) of a cylindrical environmental map is processed as follows.

[0055] First, it judges whether irow1 is larger than irow2. The whole train of the pixel to the column (jcol) of a hot link environmental map current in this condition is cold so that it may explain below (that is, the data value which shows that the correspondence pixel of a cylindrical environmental map is a hot link field is not stored). Supposing irow2 is larger than irow1, actuation of ending, and the actuation about a current column (icol) progressing to step 713 continuously, and processing the next column of a cylindrical environmental map will be performed.

[0056] However, supposing irow2 is not larger than irow1, the pixel (jrow, jcol) of the hot link environmental map corresponding to the current pixel (irow, icol) of a cylindrical environmental map will be identified. For example, the pixel (jrow, jcol) of the hot link environmental map corresponding to the current pixel (irow, icol) of a cylindrical environmental map may be judged as follows. Namely, [Equation 10] jcol = icol/SCirow = irow/SC [0057] The data value relevant to the pixel (jrow, jcol) of a hot link environmental map is checked, and this data value judges whether the correspondence pixel of a cylindrical environmental map shows that it is a hot link field. Supposing the correspondence pixel of a cylindrical environmental map is not the part of a hot link field, processing will progress to the following pixel in the train (jrow) of a hot link environmental map. However, supposing the correspondence pixel of a cylindrical environmental map is not the part of a hot link field, the color value of the pixel (irow, icol) of a cylindrical environmental map will be changed, and a pixel will be identified as a part of a hot link field. preferably, the color value of the pixel (irow, icol) of the hot link field of a cylindrical environmental map is changed by the reversible operation to the red, the blue, and (or) the green color value of a pixel. for example, supposing the true color value of 24 bits is stored about each pixel of a cylindrical environmental map, red, blue, and (or) the modification value of a green component are the followings, and can be made and determined. Namely, [Equation 11] A new value = modification (256 old value +128)

[0058] As other examples, supposing a 8-bit pallet color pointer is stored about each pixel of a cylindrical environmental map, a modification pallet color pointer is the following, and can be made and determined. Namely, [Equation 12] A new pointer = modification (256 old pointer +128)

[0059] By repeating actuation twice, I hear that the point which was excellent in this actuation can return modification, and there is. Therefore, after the user input command which switches the display of a hot link field off is received, it is not necessary to search the data of the cylindrical environmental map which has not been changed (or reloading).

[0060] Actuation progresses to step 713, after processing all the pixels of the current column (icol) of the above-mentioned range (from irow=irow1 to irow2). At step 713, it judges whether the last column (PanCol-1) of a cylindrical environmental map was processed. If not processed, actuation chooses return and the next value of icol as step 703. Supposing the last column (pancol-1) of a cylindrical environmental map is processed, actuation will progress to step 715.
[0061] At step 715, after all the columns of a cylindrical environmental map and processing of a train are completed, a modification cylindrical environmental map is drawn for a display. The detail of the drawing approach is indicated by the United States patent application 60th / No. 023 or 143. In addition, the contents of an indication of this whole specification are used as some of these specifications. Consequently, when a user's input command is a command switched to ON, the hot link field defined on the hot link environmental map is displayed. However, when a user's input command is a command switched off, step 715 displays the cylindrical environment which is not changed (that is, a hot link field is not displayed).
[0062] A system uses desirable actuation of the following in the above-mentioned step 711, and judges how [the data value in which it was stored on the hot link environmental map indicates it to be that the correspondence pixel of a cylindrical environmental map is a hot link field] it is. As an example, the red value of a pixel examines the above-mentioned case where the correspondence pixel of a cylindrical environmental map identifies whether it is a hot link field or there is nothing. In this scenario, the red value of a front pixel (jrowl) and the link status bit relevant to a front pixel (jrowl, jcol) are stored. The red value of a front pixel (jrowl, jcol) is preferably initialized by zero. The link status bit at the time of being set to "1" shows that the pixel of the cylindrical environmental map corresponding to a front pixel (jrowl, jcol) is not the part of a hot link field. The red value of the current pixel (jrow, jcol) of a hot link environment is compared with the red value of the pixel in front of a hot link environmental map (jrowl, jcol).
[0063] Supposing two values are equal, the link status bit of a front pixel (jrowl, jcol) will be read. Supposing the link status bit is set as "1", it will be judged that it is the pixel of the cylindrical environmental map corresponding to a current pixel (jrow, jcol). However, supposing a link status bit is set as "0", it will be judged that the pixel of the cylindrical environmental map corresponding to a current pixel (jrowl, jcol) is not the part of a hot link field. Furthermore, processing progresses to the next pixel of the present column (icol) of a hot link environmental map.
[0064] However, supposing two red values are not equal, a table will be searched and it will judge whether the red value relevant to a pixel (jrow, jcol) is stored as an effective item of a table.
[0065] This step ensures that a pixel (jrow, jcol) corresponds to a hot link field. When an item in agreement is not found out by the table, the red value of a front pixel (jrowl, jcol) is set as the red value of a current pixel (jrowl, jcol), a link condition is set as "0", and it is judged that the pixel of the cylindrical environmental map corresponding to a further current pixel (jrow, jcol) is not the part of a hot link field. Therefore, processing progresses to the following pixel in the current column (icol) of a hot link environmental map. Supposing an item in agreement is found, the red value of a front pixel (jrowl, jcol) will be set as a current pixel (jrow, jcol), and a link status bit will be set as "1", and it will be judged that the pixel of the cylindrical environmental map corresponding to a further current pixel (jrow, jcol) is the part of a hot link field. Furthermore, processing progresses to the following pixel in the present column (icol) of a hot link environmental map.

[0066] What should be observed here is that may store other data values (except the red value of a pixel) on a hot link environmental map, and it may be shown that the correspondence pixel of a cylindrical environmental map is a hot link field.
[0067] As explained above, the hot link environmental map of this invention offers the function (and such a display is changed) which displays many hot link fields on a panorama scene effectively, and the interactive feedback improved by this to the user of a system is offered.
[0068] As a conclusion, the following matters are indicated about the configuration of this invention.
(1) The step which offers the 1st environmental map containing two or more elements with which each was matched with the color value which is the approach of defining a hot link field as a panorama scene, and expresses said panorama scene, and expresses the color of a corresponding element, It has the step which generates the 2nd environmental map containing two or more elements which are equivalent to said element of said 1st environmental map based on a mapping function. Furthermore, at least one element of said 2nd environmental map The hot link domain-defined approach characterized by being matched with the hot link data which identify action performed in case a user chooses at least one of said the 1st environmental map corresponding to at least one element of said 2nd environmental map.
(2) Each element of said 2nd environmental map is the hot link domain-defined approach given in the above (1) characterized by corresponding or more with one of said the 1st environmental map.
(3) It is the hot link domain-defined approach given in the above (1) characterized by for said 1st environmental map and said 2nd environmental map being cylindrical environmental maps, and dividing said element of said 1st environmental map, and said element of said 2nd environmental map into the matrix which consists of a train and a column.
(4) The number of the trains of said 2nd environmental map is the hot link domain-defined approach given in the above (3) characterized by being the predetermined part of said 1st environmental map.
(5) The number of the columns of said 2nd environmental map is the hot link domain-defined approach given in the above (3) characterized by being the predetermined part of said 2nd environmental map.
(6) Said hot link data matched with at least one element of said 2nd environmental map The color value matched with at least one element of said 2nd environmental map, The hot link domain-defined approach given in the above (1) characterized by having the item of the table matched with said data which identify action performed in said color value in case a user chooses at least one element of said 1st environmental map.
It is the program storage in which reading [equipment / which materializes certainly the data used by equipment by instruction program execution / said] is possible. (7) Said data The step which offers the 1st environmental map containing two or more elements with which each was matched with the color value which expresses said panorama scene and expresses the color of a corresponding element, It has the step which generates the 2nd environmental map containing two or more elements which are equivalent to said element of said 1st environmental map based on a mapping function. Furthermore, at least one element of said 2nd environmental map Program storage characterized by being matched with the hot link data which identify action performed in case a user chooses at least one of said the 1st environmental map corresponding to at least one element of said 2nd environmental map.

(8) Each element of said 2nd environmental map is the program storing approach given in the above (7) characterized by corresponding or more with one of said the 1st environmental map.
(9) It is the program storing approach given in the above (7) characterized by for said 1st environmental map and said 2nd environmental map being cylindrical environmental maps, and dividing said element of said 1st environmental map, and said element of said 2nd environmental map into the matrix which consists of a train and a column.
(10) The number of the trains of said 2nd environmental map is the program storing approach given in the above (9) characterized by being the predetermined part of said 1st environmental map.
(11) The number of the columns of said 2nd environmental map is the program storing approach given in the above (9) characterized by being the predetermined part of said 2nd environmental map.
(12) Said hot link data matched with at least one element of said 2nd environmental map The color value matched with at least one element of said 2nd environmental map, The program storing approach given in the above (7) characterized by having the item of the table matched with said data which identify action performed in said color value in case a user chooses at least one element of said 1st environmental map.
(13) It is the approach of displaying the panorama scene expressed on the 1st environmental map containing two or more elements with which each was matched with the color value showing the color of a corresponding element on a hot link field. Two or more elements which are equivalent to said element of said 1st environmental map based on a mapping function are included. Moreover, at least one element The storage step which memorizes in memory the 2nd environmental map matched with the hot link data which identify action performed in case a user chooses at least one of said the 1st environmental map corresponding to said at least one element, The storage step which identifies at least one element of said 2nd environmental map, The color value of said element of said 1st environmental map corresponding to at least one element of said 2nd environmental map is changed. The hot link field method of presentation characterized by having the modification step which generates the 1st changed environmental map, and the drawing step which draws said 1st changed environmental map.
(14) Said modification step is the hot link field method of presentation given in the above (13) characterized by the reversible thing.
(15) Said modification step is the hot link field method of presentation given in the above (14) characterized by using an MOD function.
(16) Said discernment step, said modification step, and said drawing step are the hot link field method of presentation given in the above (14) characterized by answering a predetermined user input command and performing.
(17) Said discernment step is the hot link field method of presentation given in the above (13) characterized by having the step which analyzes said hot link data matched with two or more elements of said 2nd environmental map.
(18) Said hot link data matched with said at least one element of said 2nd environmental map are the hot link field method of presentation given in the above (17) characterized by including the color value matched with said element of said 2nd environmental map.
(19) Said hot link data matched with said at least one element of said 2nd environmental map are the hot link field method of presentation given in the above (18) characterized by including the item of the table which matches said color value with the data which identify said action performed in case a user chooses said at least one element of said 1st environmental map.

(20) With the equipment which enforces the approach of displaying the panorama scene expressed on the 1st environmental map containing two or more elements with which each was matched with the color value showing the color of a corresponding element on a hot link field It is the program storage in which reading [equipment] is possible by said equipment which materializes the program of the instruction executed certainly. Said approach Two or more elements which are equivalent to said element of said 1st environmental map based on a mapping function are included. Moreover, at least one element The storage step which memorizes in memory the 2nd environmental map matched with the hot link data which identify action performed in case a user chooses at least one of said the 1st environmental map corresponding to said at least one element, The storage step which identifies at least one element of said 2nd environmental map, The color value of said element of said 1st environmental map corresponding to at least one element of said 2nd environmental map is changed. Program storage characterized by having the modification step which generates the 1st changed environmental map, and the drawing step which draws said 1st changed environmental map.
(21) Said modification step is program storage given in the above (20) characterized by the reversible thing.
(22) Said modification step is program storage given in the above (21) characterized by using an MOD function.
(23) Said discernment step, said modification step, and said drawing step are program storage given in the above (20) characterized by answering a predetermined user input command and performing.
(24) Said discernment step is program storage given in the above (21) characterized by having the step which analyzes said hot link data matched with two or more elements of said 2nd environmental map.
(25) Said hot link data matched with said at least one element of said 2nd environmental map are program storage given in the above (24) characterized by including the color value matched with said element of said 2nd environmental map.
(26) Said hot link data matched with said at least one element of said 2nd environmental map are program storage given in the above (25) characterized by including the item of the table which matches said color value with the data which identify said action performed in case a user chooses said at least one element of said 1st environmental map.

Description of the Prior Art

Conventional three-dimension graphic application and related hardware draw the scene which consists of one or more 1-dimensional objects. Usually, a body is expressed with the shape of a geometric basic form, for example, a triangle. Moreover, a body is expressed by the graphic data showing basic form-like the location and color in model system of coordinates. A graphic device draws this scene, in order to display the object of the scene which can be seen in a view window based on a view. A user can move by changing the location and orientation of view criteria (camera) in the inside of a scene. Furthermore, activation of animation can be performed by moving in the location of a series of preselected view criteria, and the inside of orientation.

For a computer, drawing actuation is a process using an effort and is usually performed by the graphic hardware of dedication. Although such a system is highly efficient, since the hardware of the dedication assigned for the purpose is needed, costs start.

Furthermore, in the conventional three-dimension graphic application system, a user offers the three-dimension model (namely, graphic data showing the location and color of geometric criteria of a scene in model system of coordinates) of a scene. The software used together with peripheral devices (a pen tablet, a scanner, camera, etc.) may generate such a model. For example, a user can make the three-dimension model of a scene using the software currently sold as it is also at the trade name of CATIA by Daussault of France. However, at an expensive price, even if such model ring software is an imperfect scene relatively, the labor cost needed for modeling may attach it highly.

Since the cost relevant to the conventional three-dimension graphic system was high, the solution replaced with it appeared. This solution is effective. However, at the point generated and visualized, a limitation is in capacity in generation about the three-dimension scene which is suitable for use with a standard personal computer, and does not need the hardware for graphics of dedication. As an example of such a solution, software called QuicktimeVR in a trade name is Apple. It is developed by Computer and sold. This QuicktimeVR software is divided into two different packages. The 1st package is an authoring tool which enables a content provider to be sold to a content provider and to develop a solid three-dimension image from many views of one scene. The 2nd package is a viewer distributed to a consumer, and becomes possible [seeing the three-dimension image created by the authoring tool]. About the still more detailed publication about actuation of a QuicktimeVR system, it is reference:Chen, "QuicktimeR VR-An Image-based Approach to Virtual Environment Navigation", SIGGRAPH 1995, Los Angeles, CA, and pp.29-38, It reaches. Apple It is good to refer to U.S. Pat. No. 5,396,583 (Chen et al.) transferred to Computer.

A QuicktimeVR system displays the three-dimension image of one scene (or assembly of two or more images) using a cylindrical environmental map. It is drawn when different perspective drawing maps a cylindrical environmental map in a desired viewing window. A hot link is the field of the panorama scene matched with action. For example, action corresponding to a hot link may load and display the 2nd environmental map, and may generate multimedia events, such as an audio clip or a video clip.

A QuicktimeVR system offers the hot link included in a panorama scene. When a user moves cursor to the field of the scene corresponding to a hot link, and the configuration of the cursor on a display changes, a user gets to know the location of a hot link.

[Claim 1] The step which offers the 1st environmental map containing two or more elements with which each was matched with the color value which is the approach of defining a hot link field as a panorama scene, and expresses said panorama scene, and expresses the color of a corresponding element, It has the step which generates the 2nd environmental map containing two or more elements which are equivalent to said element of said 1st environmental map based on a mapping function. Furthermore, at least one element of said 2nd environmental map The hot link domain-defined approach characterized by being matched with the hot link data which identify action performed in case a user chooses at least one of said the 1st environmental map corresponding to at least one element of said 2nd environmental map.

[Claim 2] Each element of said 2nd environmental map is the hot link domain-defined approach according to claim 1 characterized by corresponding or more with one of said the 1st environmental map.
[Claim 3] It is the hot link domain-defined approach according to claim 1 characterized by for said 1st environmental map and said 2nd environmental map being cylindrical environmental maps, and dividing said element of said 1st environmental map, and said element of said 2nd environmental map into the matrix which consists of a train and a column.
[Claim 4] The number of the trains of said 2nd environmental map is the hot link domain-defined approach according to claim 3 characterized by being the predetermined part of said 1st environmental map.
[Claim 5] The number of the columns of said 2nd environmental map is the hot link domain-defined approach according to claim 3 characterized by being the predetermined part of said 2nd environmental map.
[Claim 6] Said hot link data matched with at least one element of said 2nd environmental map The color value matched with at least one element of said 2nd environmental map, The hot link domain-defined approach according to claim 1 characterized by having the item of the table matched with said data which identify action performed in said color value in case a user chooses at least one element of said 1st environmental map.
[Claim 7] It is the program storage in which reading [equipment / which materializes certainly the data used by equipment by instruction program execution / said] is possible. Said data The step which offers the 1st environmental map containing two or more elements with which each was matched with the color value which expresses said panorama scene and expresses the color of a corresponding element, It has the step which generates the 2nd environmental map containing two or more elements which are equivalent to said element of said 1st environmental map based on a mapping function. Furthermore, at least one element of said 2nd environmental map Program storage characterized by being matched with the hot link data which identify action performed in case a user chooses at least one of said the 1st environmental map corresponding to at least one element of said 2nd environmental map.
[Claim 8] Each element of said 2nd environmental map is the program storing approach according to claim 7 characterized by corresponding or more with one of said the 1st environmental map.
[Claim 9] It is the program storing approach according to claim 7 characterized by for said 1st environmental map and said 2nd environmental map being cylindrical environmental maps, and dividing said element of said 1st environmental map, and said element of said 2nd environmental map into the matrix which consists of a train and a column.
[Claim 10] The number of the trains of said 2nd environmental map is the program storing approach according to claim 9 characterized by being the predetermined part of said 1st environmental map.
[Claim 11] The number of the columns of said 2nd environmental map is the program storing approach according to claim 9 characterized by being the predetermined part of said 2nd environmental map.
[Claim 12] Said hot link data matched with at least one element of said 2nd environmental map The color value matched with at least one element of said 2nd environmental map, The program storing approach according to claim 7 characterized by having the item of the table matched with said data which identify action performed in said color value in case a user chooses at least one element of said 1st environmental map.

[Claim 13] It is the approach of displaying the panorama scene expressed on the 1st environmental map containing two or more elements with which each was matched with the color value showing the color of a corresponding element on a hot link field. Two or more elements which are equivalent to said element of said 1st environmental map based on a mapping function are included. Moreover, at least one element The storage step which memorizes in memory the 2nd environmental map matched with the hot link data which identify action performed in case a user chooses at least one of said the 1st environmental map corresponding to said at least one element, The storage step which identifies at least one element of said 2nd environmental map, The color value of said element of said 1st environmental map corresponding to at least one element of said 2nd environmental map is changed. The hot link field method of presentation characterized by having the modification step which generates the 1st changed environmental map, and the drawing step which draws said 1st changed environmental map.

[Claim 14] Said modification step is the hot link field method of presentation according to claim 13 characterized by the reversible thing.

[Claim 15] Said modification step is the hot link field method of presentation according to claim 14 characterized by using an MOD function.

[Claim 16] Said discernment step, said modification step, and said drawing step are the hot link field method of presentation according to claim 14 characterized by answering a predetermined user input command and performing.

[Claim 17] Said discernment step is the hot link field method of presentation according to claim 13 characterized by having the step which analyzes said hot link data matched with two or more elements of said 2nd environmental map.

[Claim 18] Said hot link data matched with said at least one element of said 2nd environmental map are the hot link field method of presentation according to claim 17 characterized by including the color value matched with said element of said 2nd environmental map.

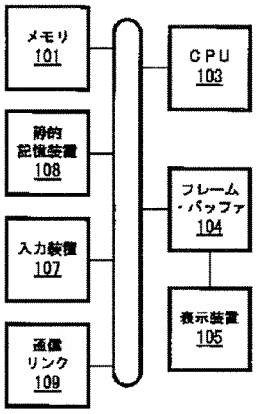
[Claim 19] Said hot link data matched with said at least one element of said 2nd environmental map are the hot link field method of presentation according to claim 18 characterized by including the item of the table which matches said color value with the data which identify said action performed in case a user chooses said at least one element of said 1st environmental map.

[Claim 20] With the equipment which enforces the approach of displaying the panorama scene expressed on the 1st environmental map containing two or more elements with which each was matched with the color value showing the color of a corresponding element on a hot link field It is the program storage in which reading [equipment] is possible by said equipment which materializes the program of the instruction executed certainly. Said approach Two or more elements which are equivalent to said element of said 1st environmental map based on a mapping function are included. Moreover, at least one element The storage step which memorizes in memory the 2nd environmental map matched with the hot link data which identify action performed in case a user chooses at least one of said the 1st environmental map corresponding to said at least one element, The storage step which identifies at least one element of said 2nd environmental map, The color value of said element of said 1st environmental map corresponding to at least one element of said 2nd environmental map is changed. Program storage characterized by having the modification step which generates the 1st changed environmental map, and the drawing step which draws said 1st changed environmental map.

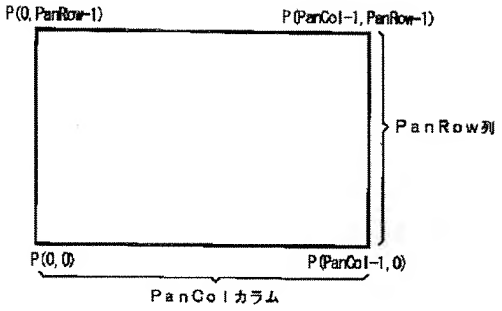
[Claim 21] Said modification step is program storage according to claim 20 characterized by the reversible thing.

[Claim 22] Said modification step is program storage according to claim 21 characterized by using an MOD function.
[Claim 23] Said discernment step, said modification step, and said drawing step are program storage according to claim 20 characterized by answering a predetermined user input command and performing.
[Claim 24] Said discernment step is program storage according to claim 21 characterized by having the step which analyzes said hot link data matched with two or more elements of said 2nd environmental map.
[Claim 25] Said hot link data matched with said at least one element of said 2nd environmental map are program storage according to claim 24 characterized by including the color value matched with said element of said 2nd environmental map.
[Claim 26] Said hot link data matched with said at least one element of said 2nd environmental map are program storage according to claim 25 characterized by including the item of the table which matches said color value with the data which identify said action performed in case a user chooses said at least one element of said 1st environmental map.

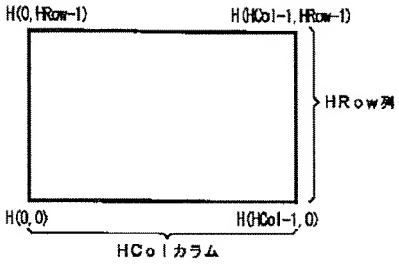
Drawing 1


メモリ
101
静的
記憶装置
108
入力装置
107
通信
リンク
109
CPU
103
フレーム
・バッファ
104
表示装置
105

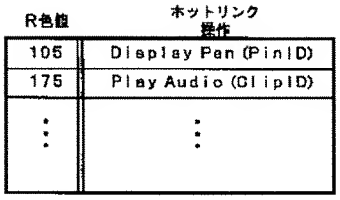
Drawing 2


P(0, PanRow-1)
P(PanCol-1, PanRow-1)
PanRow列
P(0, 0)
P(PanCol-1, 0)
PanColカラム

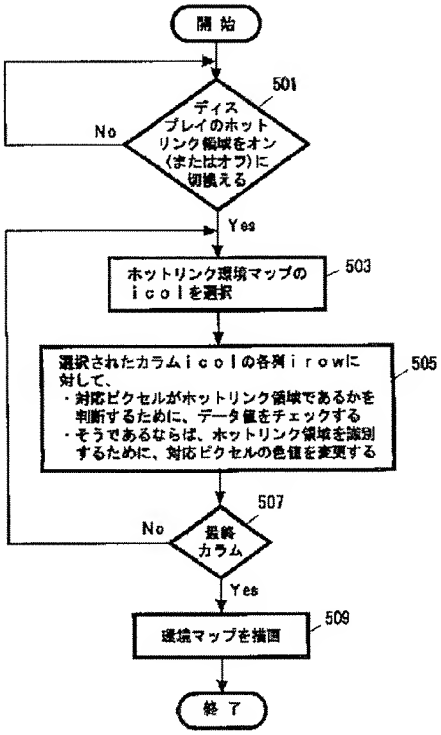
Drawing 3



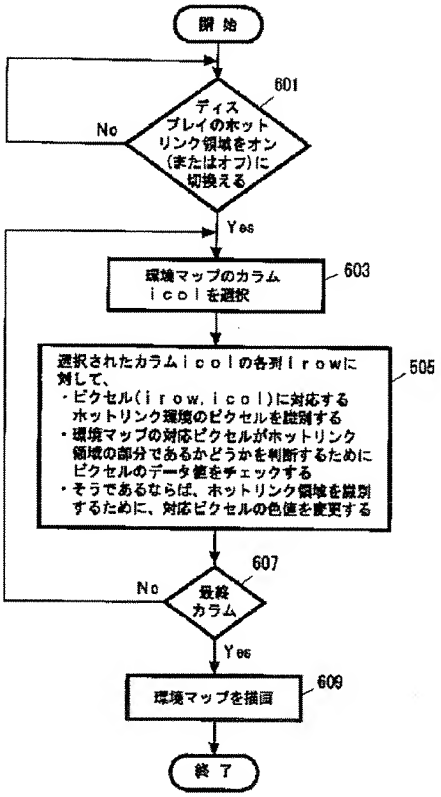
Drawing 4



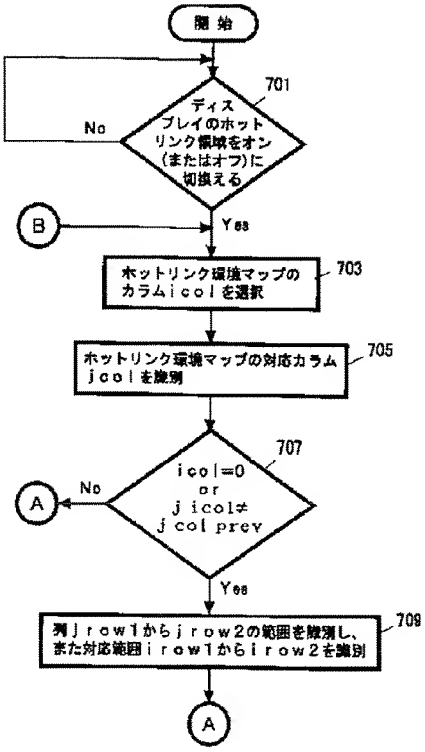
Drawing 5


開始
501
ディスプレイのホットリンク領域をオン(またはオフ)に切換える
No
Yes
503
ホットリンク環境マップのｉｃｏｌを選択
505
選択されたカラムｉｃｏｌの各列ｉｒｏｗに対して、
・対応ピクセルがホットリンク領域であるかを判断するために、データ値をチェックする
・そうであるならば、ホットリンク領域を識別するために、対応ピクセルの色値を変更する
507
最終カラム
No
Yes
509
環境マップを描画
終了

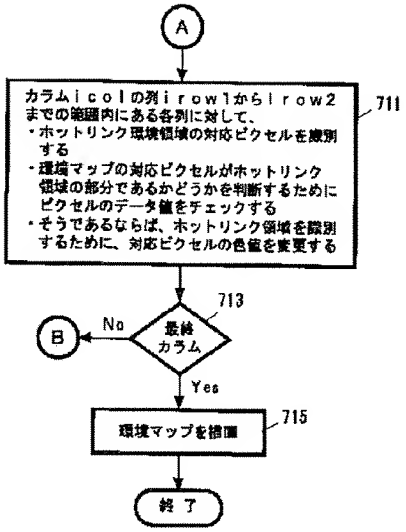
Drawing 6


開始
601
ディスプレイのホットリンク領域をオン(またはオフ)に切換える
No
Yes
603
環境マップのカラムicolを選択
505
選択されたカラムicolの各列irowに対して、
・ピクセル(irow,icol)に対応するホットリンク環境のピクセルを識別する
・環境マップの対応ピクセルがホットリンク領域の部分であるかどうかを判断するためにピクセルのデータ値をチェックする
・そうであるならば、ホットリンク領域を識別するために、対応ピクセルの色値を変更する
607
最終カラム
No
Yes
609
環境マップを描画
終了

Drawing 7


開始
701
ディスプレイのホットリンク領域をオン(またはオフ)に切換える
No
Yes
B
703
ホットリンク環境マップのカラムicolを選択
705
ホットリンク環境マップの対応カラムjcolを識別
707
icol=0 or jicol≠jcol prev
No
A
Yes
709
列jrow1からjrow2の範囲を識別し、また対応範囲irow1からirow2を識別
A

Drawing 8


A
カラムｉｃｏｌの列ｉｒｏｗ1からｉｒｏｗ2までの範囲内にある各列に対して、
・ホットリンク環境領域の対応ピクセルを識別する
・環境マップの対応ピクセルがホットリンク領域の部分であるかどうかを判断するためにピクセルのデータ値をチェックする
・そうであるならば、ホットリンク領域を識別するために、対応ピクセルの色値を変更する
711
713
最終カラム
No
B
Yes
環境マップを描画
715
終了